REMARKS

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

Conventional insulating films produced by converting a siloxane resin into silica (SiO_2) have a dielectric constant of from 3.5 to 4.2, which is too high for high frequency applications in semiconductor devices. In contrast, the present invention provides a process for producing a film having Si-C-Si structure by irradiating a siloxane compound with an electron dose of from 1 to 200 $\mu C/cm^2$. The resulting film exhibits, in combination, a low dielectric constant of 3 and or lower and improved mechanical properties, e.g., cracking resistance.

Claims 1-15 are rejected under 35 U.S.C. §102(e) over U.S. Patent No. 6,204,201 ("Ross-201"). In addition, Claim 17 is rejected under 35 U.S.C. §102(e) or, in the alternative, under 35 U.S.C. §103(a) over Ross-201. Ross-201 was filed on June 11, 1999. In contrast, the attached Declaration Under 37 § C.F.R. 1.131 establishes that Applicants reduced to practice the present invention prior to June 11, 1999. Thus, Ross-201 is not prior art to the above-identified application. Therefore, the rejections over Ross-201 should be withdrawn.

The Information Disclosure Statement filed with this Amendment discloses U.S. Patent No. 6,207,555 ("Ross-555"). Ross-555 discloses forming vias, interconnects and wiring lines between devices by applying a dielectric layer, such as a siloxane polymer, to a substrate; and irradiating the dielectric layer under conditions "sufficient to cure" an upper portion of the dielectric layer while "not substantially curing" a lower portion of the dielectric film. See, e.g., Ross-555 at abstract; column 3, lines 34-42; column 7, lines 35-43; Claims 1 and 3. However, because Ross-555 requires an uncured lower layer, which is not part of a

semiconductor device, between the cured upper layer and the substrate, Ross-555 teaches away from the independent Claim 1 limitations of "...applying ***directly*** on a ***semiconductor device*** a film comprising at least one siloxane compound; and irradiating the film comprising at least one siloxane compound with electron beams at an irradiation dose of from 1 to 200 $\mu C/cm^2$ to thereby react the siloxane compound ***throughout*** the film and generate silicon carbide bonds represented by Si-C-Si while maintaining the dielectric constant of the film at a value of 3 or lower, ...". Similarly, because Ross-555 requires an uncured lower layer between the cured upper layer and the substrate, Ross-555 teaches away from the independent Claim 20 limitations of "...providing a ***substrate*** comprising a material selected from the group consisting of ***elemental Si, SiO_2 and SiN***; applying ***directly*** on the substrate a film comprising at least one siloxane compound; and irradiating the film comprising at least one siloxane compound with electron beams at an irradiation dose of from 1 to 200 $\mu C/cm^2$ to thereby react the siloxane compound ***throughout*** the film and convert the siloxane to form silicon carbide bonds represented by Si-C-Si while maintaining the dielectric constant of the film at a value of 3 or lower, ...". The specification at page 36, Table 4, reproduced below, demonstrates that electron beam irradiation improves the cracking resistance of siloxane films.

Table 4

Example	Before electron beam irradiation				After electron beam irradiation			
	k	Hard-ness (GPa)	Si-C-Si bond	Crack-ing resist-ance	k	Hard-ness (GPa)	Si-C-Si bond	Crack-ing resist-ance
Example 8	2.6	0.71	Absent	×	2.6	0.9	Present	○
Example 9	2.3	0.50	Absent	○	2.3	0.9	Present	○
Example 10	2.2	0.25	Absent	×	2.2	0.6	Present	○
Example 11	2.2	0.25	Absent	○	2.2	0.8	Present	○
Example 12	2.6	0.71	Absent	×	2.7	1.1	Present	○
Example 13	2.3	0.50	Absent	○	2.3	0.8	Present	○
Example 14	2.6	0.71	Absent	×	2.6	1.0	Present	○

Table 4 shows that the irradiated siloxane films of independent Claims 1 and 20 have improved cracking resistance relative to Ross-555's irradiated siloxane dielectric layer having a crack-prone, substantially uncured lower portion.

The Information Disclosure Statement also discloses an assertion by Applied Materials that Matthew Ross is a co-inventor of the above-identified application. We have investigated confidential documents provided to Applicants by Applied Materials in support of Applied Materials' assertion. However, our review and analysis of the confidential documents indicates that Matthew Ross functioned only as a technician showing Atsushi Shiota how to adjust electron dose on an electron beam exposure machine. We have seen no evidence establishing that Matthew Ross is a co-inventor of the above-identified application. Instead, the evidence indicates that Atsushi Shiota and Kouji Sumiya, alone, are the co-inventors of the above-identified application.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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Attachments:

<u>McGraw-Hill Dictionary of Scientific and Technical Terms, 5th edition</u>, page 553
Declaration Under 37 § C.F.R. 1.131
Information Disclosure Statement

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NFO/CPU

deviation to the maximum modulating frequency of a frequency-modulated system under specified conditions. { ,dēv·ē'ā·shən ,rā·shō }

deviation sensitivity [NAV] A value expressed as the ratio of the rate of change in course indication to the deviation from the course line. { ,dēv·ē'ā·shən ,sen·sə'tiv·əd·ē }

deviation survey [PETRO ENG] Measurements made during a drilling operation to determine the angle from which the bit has deviated from the vertical. { ,dēv·ē'ā·shən 'sər·vā }

deviation table [NAV] A table of the deviation of a magnetic compass on various headings, magnetic or compass; for an aircraft compass, this information is usually placed on a card called a deviation card. Also known as magnetic compass table. { ,dēv·ē'ā·shən ,tā·bəl }

deviatonic stress [MECH] The portion of the total stress that differs from an isostatic hydrostatic pressure; it is equal to the difference between the total stress and the spherical stress. { ,dev·ē·ə'tän·ik 'stres }

deviatoric stress [GEOL] A condition in which the stress components operating at a point in a body are not the same in every direction. Also known as differential stress. { ¦dēv·ē·ə¦tòr·ik 'stres }

device [COMPUT SCI] A general-purpose term used, often indiscriminately, to refer to a computer component or the computer itself. [ELECTR] An electronic element that cannot be divided without destroying its stated function; commonly applied to active elements such as transistors and transducers. [ENG] A mechanism, tool, or other piece of equipment designed for specific uses. { di'vīs }

device address [COMPUT SCI] The binary code which corresponds to a unique device, referred to when selecting this specific device. { di'vīs ə'dres }

device assignment [COMPUT SCI] The use of a logical device number used in conjunction with an input/output instruction, and made to refer to a specific device. { di'vīs ə'sīn·mənt }

device cluster [COMPUT SCI] A collection of peripheral devices (usually terminals) that have a common control unit. { di'vīs ,kləs·tər }

device control character [COMPUT SCI] A special character used to direct a peripheral or communications device to perform a specific function. { di'vīs kən'trōl ,kar·ik·tər }

device driver [COMPUT SCI] A subroutine which handles a complete input/output operation. { di'vīs ,drīv·ər }

device-end condition [COMPUT SCI] The completion of an input/output operation, such as the transfer of a complete data block, recognized by the hardware in the absence of a byte count. { di'vīs ,end kən'dish·ən }

device end pending [COMPUT SCI] A hardware error in which a peripheral device does not respond when addressed by the central processing unit, usually because the device has become inoperative. { di'vīs 'end ,pend·iŋ }

device flag [COMPUT SCI] A flip-flop output which indicates the ready status of an input/output device. { di'vīs ,flag }

device independence [COMPUT SCI] Property of a computer program whose successful execution (without recompilation) does not depend on the type of physical unit associated with a given logical unit employed by the program. { di'vīs ,in·də'pen·dəns }

device-name assignment [COMPUT SCI] The designation of a peripheral device by a symbolic name rather than an address. { di'vīs ¦nām ə,sīn·mənt }

device number [COMPUT SCI] The physical or logical number which refers to a specific input/output device. { di'vīs ,nəm·bər }

device selector [COMPUT SCI] A circuit which gates data-transfer or command pulses to a specific input/output device. { di'vīs si'lek·tər }

devil *See* devil float. { 'dev·əl }

devil float [ENG] A hand float containing nails projecting at each corner and used to roughen the surface of plaster to provide a key for the next coat. Also known as devil; nail coat. { 'dev·əl ,flōt }

devillite [MINERAL] $Cu_4Ca(SO_4)_2(OH)_6 \cdot 3H_2O$ A dark-green mineral consisting of a hydrous basic sulfate of copper and calcium, occurring in six-sided platy crystals. { də'vē,līt }

devil on two sticks *See* devil's curve. { 'dev·əl ȯn ,tü 'stiks }

devil's curve [MATH] A plane curve whose equation in cartesian coordinates x and y is $y^4 - a^2y^2 = x^4 - b^2x^2$, where a and b are constants. Also known as devil on two sticks. { 'dev·əlz 'kərv }

devil's pitchfork [DES ENG] A tool with flexible prongs used in recovery of a bit, underreamer, cutters, or such lost during drilling. { 'de·vəlz 'pich,fȯrk }

devitrification [CHEM] The process by which the glassy texture of a material is converted into a crystalline texture. { dē,vi·trə·fə'kā·shən }

devitrified glass [MATER] A glassy material which has been changed from a vitreous to a brittle crystalline state during manufacture. { dē'vi·trə,fīd 'glas }

devolatilize [CHEM ENG] To remove volatile components from a material. { ,dē'väl·ə·tə,līz }

Devonian [GEOL] The fourth period of the Paleozoic Era, covering the geological time span between about 412 and 354×10^6 years before present. { di'vō·nē·ən }

De Vries effect [GEOCHEM] A relatively short-term oscillation, on the order of 100 years, in the radiocarbon content of the atmosphere, and the resulting variation in the apparent radiocarbon age of samples. { də'vrēz i'fekt }

devrinol [ORG CHEM] $C_{17}H_{21}O_2N$ A brown solid with a melting point of 68.5–70.5°C; slight solubility in water; used as a herbicide for crops. Also known as 2-(α-naphthoxy)-*N,N*-diethylpropionamide. { 'dev·rə,nȯl }

dew [HYD] Water condensed onto grass and other objects near the ground, the temperatures of which have fallen below the dew point of the surface air because of radiational cooling during the night but are still above freezing. { dü }

Dewar calorimeter [ENG] **1.** Any calorimeter in which the sample is placed inside a Dewar flask to minimize heat losses. **2.** A calorimeter for determining the mean specific heat capacity of a solid between the boiling point of a cryogenic liquid, such as liquid oxygen, and room temperature, by measuring the amount of the liquid that evaporates when the specimen is dropped into the liquid. { ¦dü·ər ,kal·ə'rim·əd·ər }

Dewar flask [PHYS] A vessel having double walls, the space between being evacuated to prevent the transfer of heat and the surfaces facing the vacuum being heat-reflective; used to hold liquid gases and to study low-temperature phenomena. { 'dü·ər ,flask }

Dewar structure [ORG CHEM] A structural formula for benzene that contains a bond between opposite atoms. { 'dü·ər ,strək·chər }

dewaterer [MECH ENG] Wet-type mechanical classifier (solids separator) in which solids settle out of the carrier liquid and are concentrated for recovery. { dē'wȯd·ər·ər }

dewatering [ENG] **1.** Removal of water from solid material by wet classification, centrifugation, filtration, or similar solid-liquid separation techniques. **2.** Removing or draining water from an enclosure or a structure, such as a riverbed, caisson, or mine shaft, by pumping or evaporation. { dē'wȯd·ər·iŋ }

dewaxed oil [MATER] Lubricating oil that has had a portion of the wax removed. { dē'wakst 'ȯil }

dewaxing [CHEM ENG] Removing wax from a material or object; a process used to separate solid hydrocarbons from petroleum. { dē'waks·iŋ }

dewcap [OPTICS] An open tube attached to the end of a refracting telescope to prevent moisture from condensing on the objective. { 'dü,kap }

dew cell [ENG] An instrument used to determine the dew point, consisting of a pair of spaced, bare electrical wires wound spirally around an insulator and covered with a wicking wetted with a water solution containing an excess of lithium chloride; an electrical potential applied to the wires causes a flow of current through the lithium chloride solution, which raises the temperature of the solution until its vapor pressure is in equilibrium with that of the ambient air. { 'dü ,sel }

dewclaw [VERT ZOO] **1.** A vestigial digit on the foot of a mammal which does not reach the ground. **2.** A claw or hoof terminating such a digit. { 'dü,klȯ }

dewetting [MET] Flow of solder away from the soldered surface during reheating following initial soldering. { dē,wed·iŋ }

deweylite [MINERAL] A mixture of clinochrysolite and stevensite. Also known as gymnite. { 'dü·ē,līt }

dewindtite [MINERAL] $Pb(UO_2)_2(PO_4)_2 \cdot 3H_2O$ A canary-yellow secondary mineral consisting of a hydrous phosphate of lead and uranium. { də'win,tīt }

de Witte relation [GEOPHYS] Graphical plot of the relation between electrical conductivity and distance over which the

DEVONIAN

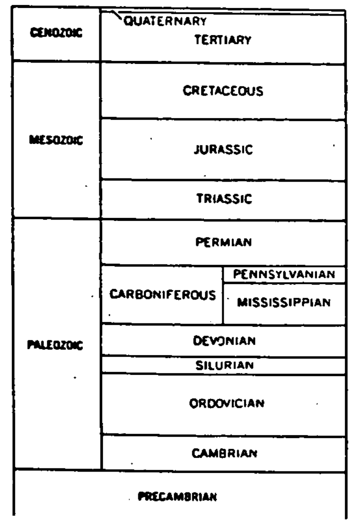
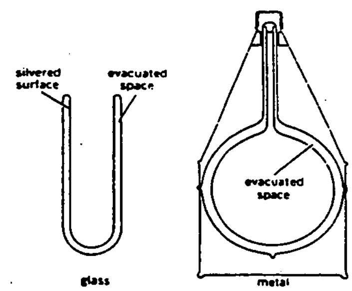


Chart showing relationship of Devonian to other periods.

DEWAR FLASK



Typical Dewar containers.

On the cover: Photomicrograph of crystals of vitamin B_1.
(Dennis Kunkel, University of Hawaii)

In addition, material has been drawn from the following references: R. E. Huschke, *Glossary of Meteorology*, American Meteorological Society, 1959; *U.S. Air Force Glossary of Standardized Terms*, AF Manual 11-1, vol. 1, 1972; *Communications-Electronics Terminology*, AF Manual 11-1, vol. 3, 1970; W. H. Allen, ed., *Dictionary of Technical Terms for Aerospace Use*, 1st ed., National Aeronautics and Space Administration, 1965; J. M. Gilliland, *Solar-Terrestrial Physics: A Glossary of Terms and Abbreviations*, Royal Aircraft Establishment Technical Report 67158, 1967; *Glossary of Air Traffic Control Terms*, Federal Aviation Agency; *A Glossary of Range Terminology, White Sands Missile Range, New Mexico*, National Bureau of Standards, AD 467-424; *A DOD Glossary of Mapping, Charting and Geodetic Terms*, 1st ed., Department of Defense, 1967; P. W. Thrush, comp. and ed., *A Dictionary of Mining, Mineral, and Related Terms*, Bureau of Mines, 1968; *Nuclear Terms: A Glossary*, 2d ed., Atomic Energy Commission; F. Casey, ed., *Compilation of Terms in Information Sciences Technology*, Federal Council for Science and Technology, 1970; *Glossary of Stinfo Terminology*, Office of Aerospace Research, U.S. Air Force, 1963; *Naval Dictionary of Electronic, Technical, and Imperative Terms*, Bureau of Naval Personnel, 1962; *ADP Glossary*, Department of the Navy, NAVSO P-3097.

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